

## APPENDIX

The Plans, Procedures, and Safety Considerations document that was prepared prior to operational activities of SRWRT is included in this appendix. This document provided the basis for operational activities and safety review for the SRWRT program and provides the foundation for future program planning for large-scale exhuming of Rocky Flats waste from the NRTS Burial Ground.

APPENDIX  
SOLID RADIOACTIVE WASTE RETRIEVAL TEST  
(SRWRT)

PLANS, PROCEDURES, AND SAFETY CONSIDERATIONS

R. J. Thompson

## SOLID RADIOACTIVE WASTE RETRIEVAL TEST (SRWRT)

### I. INTRODUCTION

About 2,500,000 ft<sup>3</sup> of the solid waste interned at the NRTS Burial Ground is transuranic nuclide contaminated, low-level waste from the AEC Rocky Flats operation. Because of the concern over long-term isolation, the AEC has elected to eventually move this waste to a Federal repository. An operation of this magnitude presents many varied problems and may require extensive facilities. Therefore, the AEC has requested the Idaho Chemical Programs - Operations Office of Allied Chemical Corporation to perform a series of solid waste retrieval tests at the burial ground to gain insight into the problems that may arise from a future large-scale exhuming operation. The retrieval tests consist of excavating and studying the contents of containers (barrels and boxes) from three representative sites within the burial ground. In addition, the AEC has requested that three specific barrels be retrieved from the burial ground and set aside for special analysis.

This document describes the overall experimental program, wastes, waste locations, excavation procedures, and safety aspects of the Solid Radioactive Waste Retrieval Tests, SRWRT.

## II., EXPERIMENTAL PROGRAM

Figure 1 shows the overall sequence of the program for the Solid Radioactive Waste Retrieval Test. In preparation for initiating retrieval work, written procedures have been prepared, as presented in the Appendix, for safety consideration and review. During the test work, excavation sites will be staked out based on information obtained from burial ground records. Allied personnel will then take soil samples from the sites and obtain analyses of possible radioactive contamination. The bulk of the soil will be removed using heavy equipment. The waste containers will be exhumed by hand labor; frequent samples will be taken during this phase. The waste containers will then be transported by Hot Waste Dumpsters to the hot cell facilities at ARA where the containers will be opened and sorted into two fractions--combustible and noncombustible. The wastes will be photographed, samples, repackaged, and returned to the Improved Temporary Storage Area (ITSA) pad at the NRTS Burial Ground, pending ultimate disposal. The three specific barrels to be exhumed will not undergo the full test sequence but will be set aside on the ITSA pad, pending further instructions from the AEC, following removal from the burial ground pits. A report will be issued summarizing the findings of SRWRT and making recommendations for future removal, treatment, and repackaging of the waste for ultimate storage as described in CI-1200.

Table I identifies the individuals and groups who are involved in the test program. Overall technical and operational responsibility has been assigned to the SRWRT Project Engineer, R. J. Thompson of Allied Chemical Corporation. Aerojet Nuclear Corporation health physicists will provide direct HP support for SRWRT operations. Allied Chemical Corporation health physicists will perform a surveillance function. AEC-HSL will perform "outside-the-fence" monitoring as a check and verification of the SRWRT contamination control procedures.

Table II shows the expected time schedule for accomplishing the SRWRT program. The timing is such that careful coordination and cooperation are required. Inclement weather may limit excavation activities, so early completion of this phase of the work is imperative.

### 1. DESCRIPTION AND LOCATION OF EXCAVATIONS

Figure 2 shows the approximate location of each burial ground site that has been selected for excavation. Excavation Site 1 is located in Pit 11, 5 to 10 feet east and 10 to 95 feet south of the northwest pit monument. Excavation Site 2 is located in Pit 5, 75 feet south of the north-east monument. Excavation Site 3 is located in Pit 2, Row No. 1, that runs north-south, 3 feet west of the southeast pit monument. Site 4 is in Pit 11, 125 to 130 feet east and 10 to 95 feet south of the northwest corner monument. Site 5 also is in Pit 11, 80 to 85 feet east and 15 to 95 feet south of the northwest corner monument. Sites 1, 2, and 3 are multiple container sites and 4, 5, and 6 are single container sites.

Fig. 1 Overall SRWRT Program

TABLE I

## INDIVIDUAL AND ORGANIZATIONAL RESPONSIBILITY

Operation	Responsible Individual	Performing Organization	HP Support	Surveillance
1. Overall Responsibility	R. J. Thompson	ACC-Waste Processing Tech	--	--
2. Procedures Preparation	R. J. Thompson	ACC-Waste Processing Tech	--	--
3. Safety Review	K. L. Rohde, Chairman R. B. O'Brien	ACC Safeguard Review Board ANC-NOS Division	--	--
4. Site Survey	R. D. Bowman	ANC-Const. Eng.	--	ANC-NOS
5. Excavation	A. L. Olsen	ANC-Maintenance	ANC-NOS	ACC-HP AEC-HSL
6. Transportation (to and from Hot Cell)	A. L. Olsen	ANC-Maintenance	ANC-NOS	ACC-HP AEC-HSL
7. Hot Cell Operation	J. A. Hanny	ANC-Hot Cell Operations	ANC	ACC-HP
8. Analytical	B. A. Staples	ICPP Analytical	--	--
9. Storage	C. E. Nichols	ANC-Maintenance	ANC-NOS	ACC-HP
10. Reporting	R. J. Thompson	ACC-Waste Processing Tech	--	--

TABLE II  
SRWRT SCHEDULE (FY 1972)

<u>Task</u>	<u>August</u>	<u>September</u>	<u>October</u>	<u>November</u>	<u>December</u>
Procedures Finalized	██████				
Safety Review	██████				
3-Single Barrels Exhumed		██████			
Multiple Barrel Excavations		-----████████████████████			
Sorting and Final Storage				██████	
Report	-----	-----	-----	████████████████████	



Data on the waste that is expected to be retrieved at each site are summarized in Table III. The single barrel wastes will be exhumed first, beginning with the two barrels in Pit 11 and then the barrel in Pit 10. Finally, the multiple container excavations beginning with the wastes buried in 1970 and ending with the wastes buried in 1961 will be made.

The excavation sites are in areas of medium soil depth for the NRTS Burial Ground. Figure 3 shows the approximate soil depths for the burial ground in general and the SRWRT excavation sites in particular. The soil depth for the excavations is expected to be between 5 and 12.5 feet.

## 2. OPERATIONAL PROCEDURES

The procedures that will be used to exhume and study the wastes in the SRWRT program are presented in the Appendices.

Appendix A--Burial Ground Excavation and Transportation Procedure

Appendix B--Sample, Photograph and Container Numbering Procedure

Appendix C--Hot Cell Sorting and Sampling Procedure

Appendix D--Analytical Procedure for Alpha Contaminant Determination

Appendix E--SRWRT Handling Tools

The procedures define individual and functional responsibility and safety requirements of each operation. As data are gathered, it may be desirable to modify the procedures to reflect knowledge being gained during the program.

TABLE III

## SRWRT - EXCAVATION SITE WASTE DATA

Item	Excavation Site					
	1	2	3	4	5	6
Seal	RF 7722	RF 2601	RF 1425	RF C3492	RF 7762	RF 3412
Dow Serial No.	70-94B	64-64-B	61-1P	70-21-B	70-134-B	69-145B-1
Drum No.	--	--	--	771-7285	771-16500	771-3431
No. of Containers	5-7	5-7	5-7	1	1	1
Container Types	Drum	Drum, Box	Drum	Drum	Drum	Drum
Waste Type	Pu, Am	U, Pu	U, Pu	Pu	Pu	Pu, Am
Burial Date	4/70	8/64	1/61	6/70	6/70	9/70
Burial Ground Pit No.	11	5	2	11	11	10

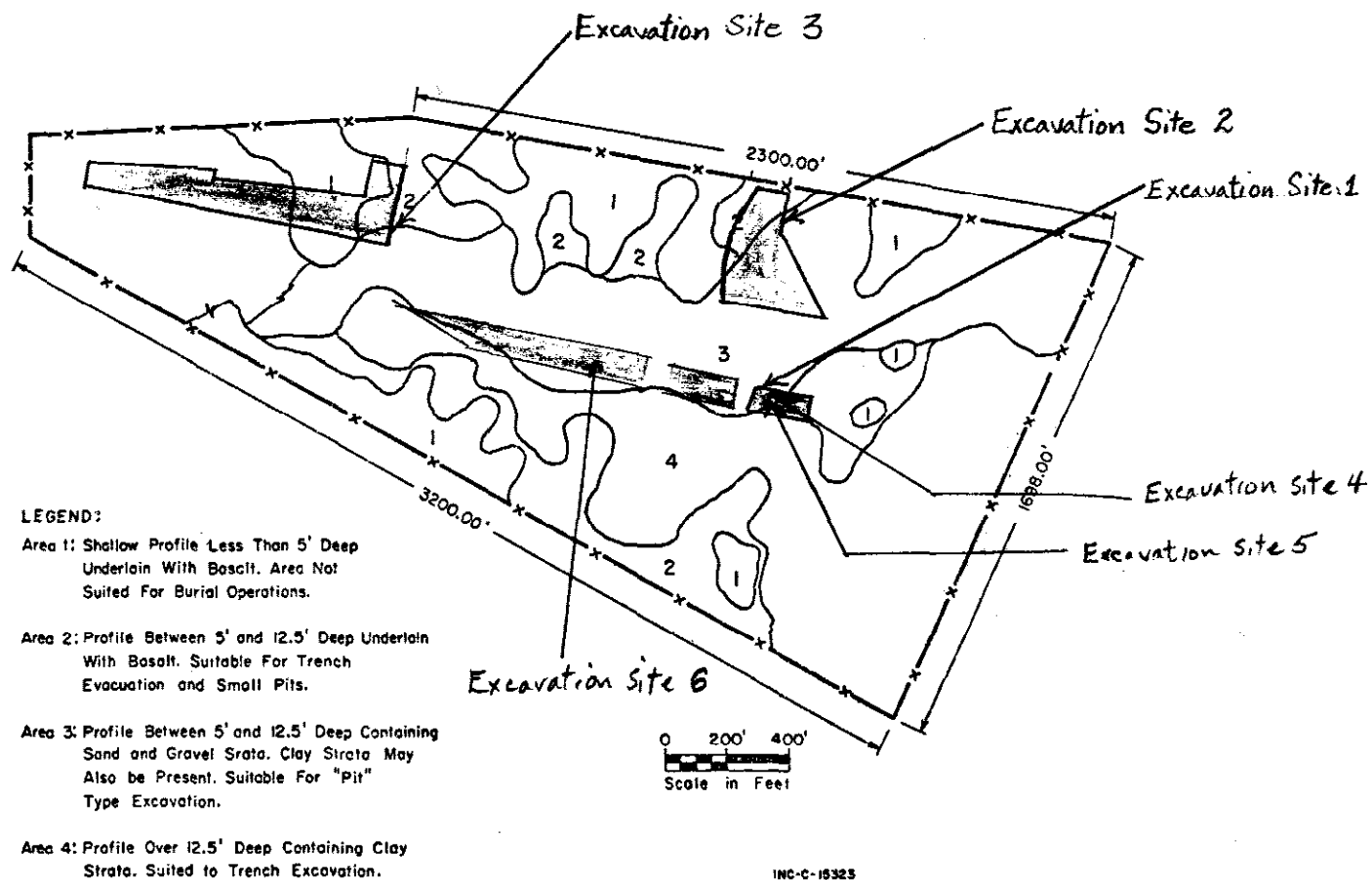


Fig. 3 Burial ground soil depth map and SRWRT excavation sites.

### III. SAFETY CONSIDERATIONS

The safety aspects of activities have been reviewed to determine the effects that SRWRT operations might have on personnel and on the environs. No insurmountable difficulties were found. The safety considerations included fire, criticality, direct radiation hazard, inhalation radiation hazard, contamination spread, and provisions to prevent and control such occurrences. Further safety consideration detail is presented in the appended procedures. Based on these analyses, it is concluded that the operation can be accomplished with a minimum and entirely acceptable risk.

Based on the burial ground records, none of the waste containers are indicated to be chemically reactive; however, the containers will be handled as if they were chemically reactive at all times. Safety glasses and protective clothing will be required. Eye wash facilities and first aid equipment will be available during all handling operations.

#### 1. FIRE

Provisions have been made to handle any credible fire that might occur. During burial ground operations and transportation, portable fire extinguishers will be available for individual immediate action. These extinguishers include CO<sub>2</sub>, ABC, and MgO sand. In addition, radio communications with the Central Facilities will be maintained in case Fire Department assistance becomes necessary. At the ARA Hot Cell No. 1, similar portable extinguishers will be readily available in the cell, as well as a remotely operated METL-X and ABC system in the cell. At ARA, only one container will be permitted in the cell at one time; thus, the quantity of contaminated combustibles will be limited.

#### 2. CRITICALITY

Conceivably, Pu in the waste containers presents a possibility for a criticality incident. Normally, the quantity of Pu in a container is limited to <200 g Pu/barrel, which is far below criticality limits. Since no criticality has occurred in the burial ground stacks, criticality is not believed to be a problem with the waste in a single container. When containers are moved from excavation sites or handled in transit, minimum spacing of two feet--edge to edge--will be maintained to preclude interaction. Only one waste container will be handled in the hot cell at a time to limit possible interactions in the cell.

#### 3. DIRECT RADIATION HAZARD

The wastes that are scheduled for excavation in the SRWRT program are not in areas of the NRTS  $\beta$ - $\gamma$  wastes. The burial ground records have been

searched to insure this point. However, health physics support from Allied Chemical Corporation will include adequate  $\beta$ - $\gamma$  monitoring to verify that  $\beta$ - $\gamma$  bearing wastes are not being encountered.

#### 4. INHALATION RADIATION HAZARD

The nature of plutonium dictates that maximum precautions be invoked to ensure personnel safety. Soil samples prior to and during excavations will be used to identify potential Pu hazard. Portable air monitors will be deployed at every excavation to determine the effectiveness of contamination control techniques. Personnel who are allowed to enter ARA Hot Cell No. 1 during sorting and opening operations will be dressed in full protective clothing and full face mask.

#### 5. CONTAMINATION SPREAD

The liberal use of plastic sheeting to cover excavation sites and limited application of water to control dust and contamination spread are planned. Initial excavations will be conducted under wind speed control of 10 mph, or less, at the 20-foot level, measured at the EBR-I Meteorological Station. If air and soil sample data reflect successful control of contamination, relaxation of wind speed requirements may be invoked.

In the hot cell operation, a sealed plastic tent will be used in conjunction with HEPA filters. Air flow will be from the isolation room through the initial HEPA filters into ductwork and a set of roughing filters followed by a second set of HEPA filters (see Figure C-1).

Double bagging of waste containers at the burial ground and hot cell will be used to ensure contamination control. No waste will leave the burial ground without passing through the burial ground control point where the support health physicist will satisfy himself that no contamination external to the containers will leave the burial ground. The containers will then be released for transport from the burial ground.

Barrels that are of questionable integrity will not be moved until wall thickness measurements, using an ultrasonic wall thickness tester, have been obtained to determine barrel integrity of the barrel wall. Special handling tools have been devised to prevent undue strain to containers during excavation. These tools will be used to supplement standard handling techniques.

#### IV. APPENDIX

The detailed procedures that will be employed during the Solid Radioactive Waste Retrieval Tests may be found in the Appendix.

APPENDIX A

SOLID RADIOACTIVE WASTE RETRIEVAL TEST  
(SRWRT)

BURIAL GROUND EXCAVATION AND TRANSPORTATION PROCEDURE\*

Excavation No. \_\_\_\_\_

Prepared by R. J. Thompson 8-31-71  
R. J. Thompson Date

Procedure Approved: L. T. Lacey 9/7/71  
Allied Chemical Corporation Date

L. B. Brown 9/7/71  
Aerojet Nuclear Company Date

1. PURPOSE

The purpose of this procedure is to define the steps necessary to exhume waste from the NRTS Burial Ground and to transport the waste to the sorting and sampling hot cell in support of SRWRT. Administrative control and responsibility are defined.

2. SAFETY REQUIREMENTS

2.1 Specific safety equipment that must be at the Burial Ground Control Point for all excavations in support of SRWRT is listed below:\*\*

2.11 Radio for communications to Central Facilities

2.12 Fire Extinguishers

2.121 2 30-# Metal-x

2.122 2 15-# CO<sub>2</sub>

2.123 2 10-gal can MgO sand

2.124 2 15-# ABC

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\*One set of procedures will be issued for each excavation.

\*\*See Paragraph 2.15 for the location of the control point.

- 2.13 Health Physics Equipment and Industrial Safety Equipment
  - 2.131 GM instrument ( $\beta, \gamma$ ), sensitive to 60 kev range.
  - 2.132 Ludlum instrument (equipped with  $\alpha$  probe) or Eberline instrument.
  - 2.133 Hard hats and safety glasses.
  - 2.134 Anti-C clothing (coats, jumpers, booties, etc.)
  - 2.135 Full face masks.
  - 2.136 Spare portable air sampler with generator.
  - 2.137 Dust masks (ultra filter)
  - 2.138 Plastic bags
  - 2.139 Portable eye wash
- 2.14 Control Point location is at main exit gate from burial ground (see Figure 2).
- 2.2 The following conditions must be adhered to at all times during digging operations. Soil samples will be collected prior to digging for determining the contamination level. The level of contamination will determine protective clothing, etc., required.
  - 2.21 Full protective clothing for personnel at the excavation site will be required if the alpha soil contamination is expected to exceed  $1 \times 10^{-4}$   $\mu\text{Ci/g}$  soil based on soil samples at any point in the excavation. Full protective clothing is defined as full face mask, two pairs of cotton overalls, one pair of plastic booties, one pair of latex boots, cotton hood, one pair surgeon's gloves, and one pair cotton gloves. The sleeves, hood, etc., shall be taped shut.
  - 2.22 Partial protective clothing for personnel at the excavation site will be required if alpha soil contamination is expected to be in the range of  $1 \times 10^{-6}$  to  $1 \times 10^{-4}$   $\mu\text{Ci/g}$  soil. Partial protective clothing is defined as dust respirator, coveralls, canvas booties, and cotton gloves.
  - 2.23 No protective clothing will be required except as defined by the ANC HP if the alpha soil contamination level is expected to be  $< 1 \times 10^{-6}$   $\mu\text{Ci/g}$  soil. Dust ultra filter respirators must be available to each person at the excavation site hung around the neck for quick use.

- 2.24 One health physicist must be at the excavation site at all times during excavation, with appropriate monitoring equipment, and shall perform the HP functions defined in NOS-SP 6.10-1-2.
- 2.25 One or more portable air samplers shall be located down wind (or in the prevailing direction), and one or more portable air samplers shall be located upwind of each excavation site. In the event of unstable wind direction, as many samplers as required will be used to provide downwind samples.
- 2.26 One of the following people must be present during all burial ground excavation activities:
- 2.261 SRWRT Project Engineer.
- 2.262 A designated alternate.
- 2.27 The decision to dig, based on existing weather conditions, shall be the prerogative of the SRWRT Project Engineer or his designated alternate who will consult the HP on duty. Initially, excavations shall be done with wind speed of 10 mph, or less, measured at the 20-foot level at EBR-I Meteorological Station.
- 2.3 Off-Normal Operations: In the event that any container is ruptured, or is found open during excavation, excavation shall stop, and the immediate area shall be evacuated. The HP on duty and the SRWRT Project Engineer, wearing full protective clothing, will seal the container with plastic or take such action as deemed appropriate to minimize contamination spread. Assistance will be called for as required. The Burial Ground Supervisor will be notified as soon as practicable and the appropriate follow-on action determined in cases of significant contamination.
- In the event of fire at the burial ground that involves waste potentially contaminated with alpha, evacuate up-wind or as directed by the HP and contact the fire department. The SRWRT Project Engineer or his designated alternate shall take further action that he deems appropriate.
- 2.4 Photographs will be taken at the discretion of the SRWRT Project Engineer.
- 2.5 When the excavation defined in the sketch in paragraph 3.3 is complete, 15 mil polyvinyl plastic sheet will be used to cover the excavation. This covering will be removed as required during subsequent operations. The excavation site must be covered following each day's activities. The soil and extra containers removed during excavation will be returned to the excavation when work at a site is complete, and the site shall be covered with soil.
- 2.6 It is the responsibility of the SRWRT Project Engineer to maintain the written log of events and record unusual and pertinent occurrences. Each entry must be accompanied by date, time, and initials. Instructions or changes in instructions issued to equipment operators shall be entered in the log book.

- 2.7 Limited application of water to control contamination may be used. The SRWRT Project Engineer will make the determination on the extent and on the use of water.

### 3. EXCAVATION

- 3.1 Description of the waste (from Burial Ground Records):

- 3.2 Location of the waste (sketch based on Burial Ground Records):

- 3.3 Survey sketch of the excavation site:

The survey is complete and site marked per the survey sketch.

\_\_\_\_\_  
Survey Crew

\_\_\_\_\_  
Date

- 3.4 Soil samples per survey sketch. Samples collected and sent to ICPP (Attention: Bruce Staples)

\_\_\_\_\_  
Sample Crew

\_\_\_\_\_  
Date

- 3.5 Results of Soil Sample Analysis:

- 3.6 The required safety equipment is available at the burial ground control point as defined in this procedure.

\_\_\_\_\_  
HP

\_\_\_\_\_  
Date

- 3.7 Approval to proceed with excavation

\_\_\_\_\_  
C. E. Nichols

\_\_\_\_\_  
Date

\_\_\_\_\_  
R. J. Thompson

\_\_\_\_\_  
Date

- 3.8 The SRWRT Project Engineer will issue verbal instructions to the equipment operators to begin the excavation and record the instructions in the Log Book. Shoring will be used as required per AEC Manual 0500-1 and Corps of Engineers Manual EM385-1-1.

- 3.9 Proceed to uncover the waste containers (drums or boxes) by hand digging, following initial dirt removal by heavy equipment. When the containers are exposed, smear and survey the containers. If the smears or survey indicate  $>500$  cpm, based on  $100\text{ cm}^2$  area, treat the container as a "leaker". Full protective clothing is required. If less than 500 cpm, as measured by a survey meter, proceed with uncovering the waste. Collect soil samples as directed by SRWRT Project Engineer or his designated alternate. Number the containers per instructions from SRWRT Project Engineer. Look for identifying tags or numbers on the containers, and make certain they will remain intact during the test. Record in the Log Book. Photograph the containers in position. See procedure in Appendix B. Diking around excavation sites will be used to preclude water from running into the excavation hole.

- 3.10 If the container is a drum, obtain wall thickness measurements by an ultrasonic wall thickness instrument (approximately 50 readings in the upper and 50 in the lower half). Record the maximum and the minimum readings obtained in the Log Book.

If the maximum thickness is  $>72$  mils, check the instrument. If the minimum thickness is  $<30$  mils, do not move the drum until after consulting the SRWRT Project Engineer. If the minimum thickness is 30 mils, or greater, select the appropriate handling tool (see Appendix E) and exhume the drum. At a position near the excavation site, weigh the drums. (A scale will be provided as part of the equipment for the excavations.) If it weighs more than 300 pounds, set the drum aside, as it probably contains sludge. Select another drum and repeat the excavation procedure. Record all weights and drums in the Log Book. If the drum weighs less than 300 pounds, smear for contamination and bag for transport to the control point.

If the container is a box, uncover the containers nearest the ground level. Select the appropriate handling tool (see Appendix E) and exhume the box. Smear for contamination and bag (or cover with plastic) for transport to the control point or set aside and proceed to exhume the next container.

At the control point, bag the drum or box again and place in the transport container for transport to the ARA Hot Cell No. 1.

- 3.11 When the desired number of containers are removed from the excavation, sample the soil under the containers for alpha contamination per instructions from the SRWRT Project Engineer or his designated alternate. Transmit the samples to ICPP for analysis (Attention: Bruce Staples). Replace drums not being sent to ARA Hot Cell No. 1 and cover the excavation with soil previously removed.
- 3.12 SRWRT Project Engineer shall contact the ARA Hot Cell personnel (notify of shipment and alert 24 hours in advance, where possible, prior to movement of wastes to the ARA Hot Cell). Movement of wastes to and from the burial ground shall be accomplished in accord with INPP 8.15, Control of Source and Special Nuclear Material and in accord with regulations for on-site shipment of radioactive material.

3.13 Approval to Proceed

<u>C. E. Nichols</u>	<u>                    </u>	<u>R. J. Thompson</u>	<u>                    </u>
	Date		Date

- 3.14 Transport via the route outlined in Figure A-1.

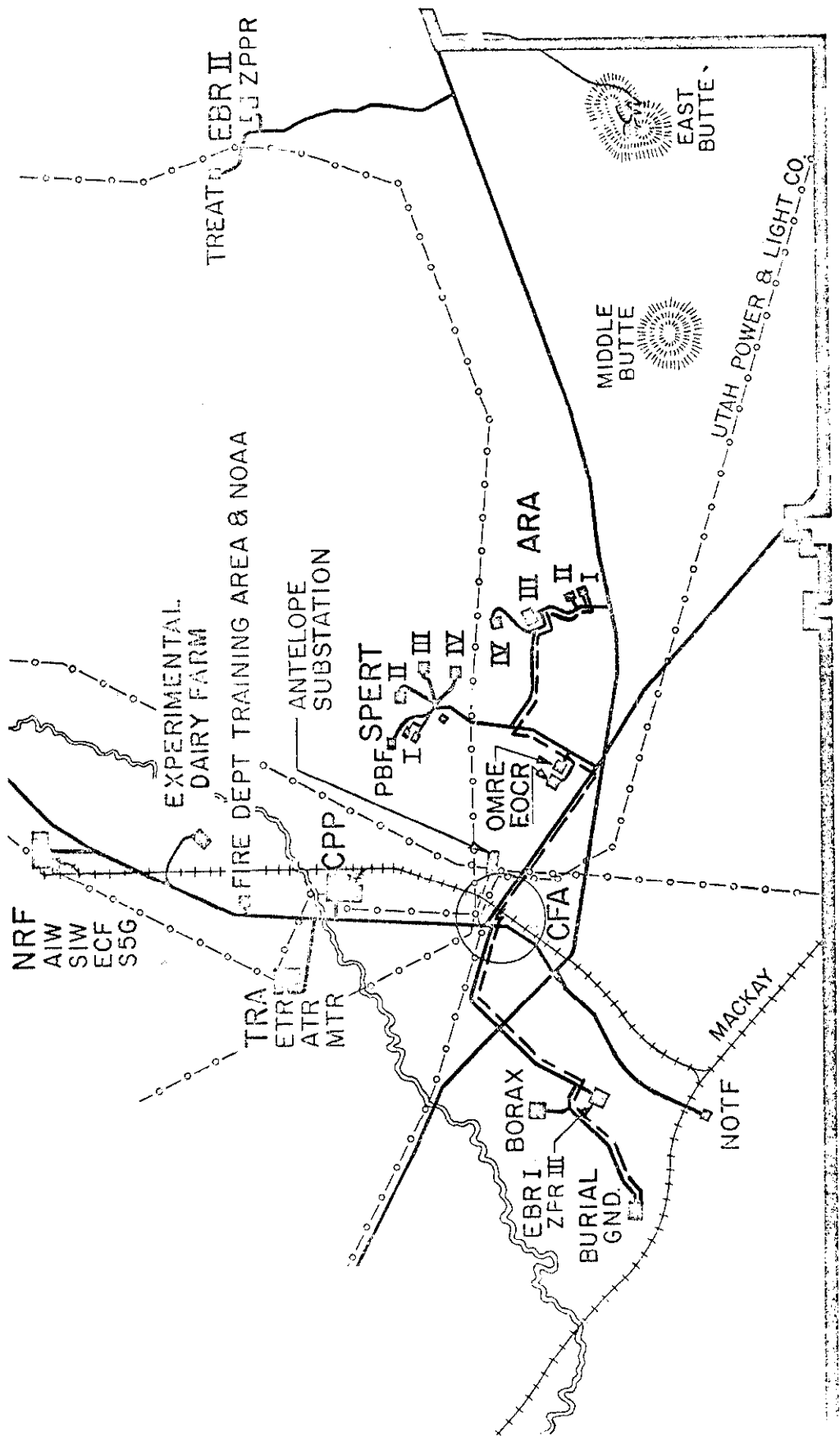


Fig. A-1. Burial Ground - ARA transport route.

## APPENDIX B

### SOLID RADIOACTIVE WASTE RETRIEVAL TEST (SRWRT)

#### SAMPLE, PHOTOGRAPH AND CONTAINER NUMBERING PROCEDURE

##### 1. PURPOSE

The purpose of this procedure is to ensure a consistent, accurate numbering scheme for all containers, samples and photographs throughout the SRWRT program.

##### 2. GENERAL

All boxes, drums, soil samples, samples from drums, or special samples will be numbered and the number and written description recorded in the Burial Ground or ARA Hot Cell Log Book. Where more than one sample is involved sequential numbering shall be used that runs from left to right, top to bottom.

##### Special Nomenclature:

I,II,III.....Excavation site

D.....Drum

B.....Box

CS.....Core Sample

DS.....Drum Sample

BS.....Box Sample

1,2,3.....Sequential Number

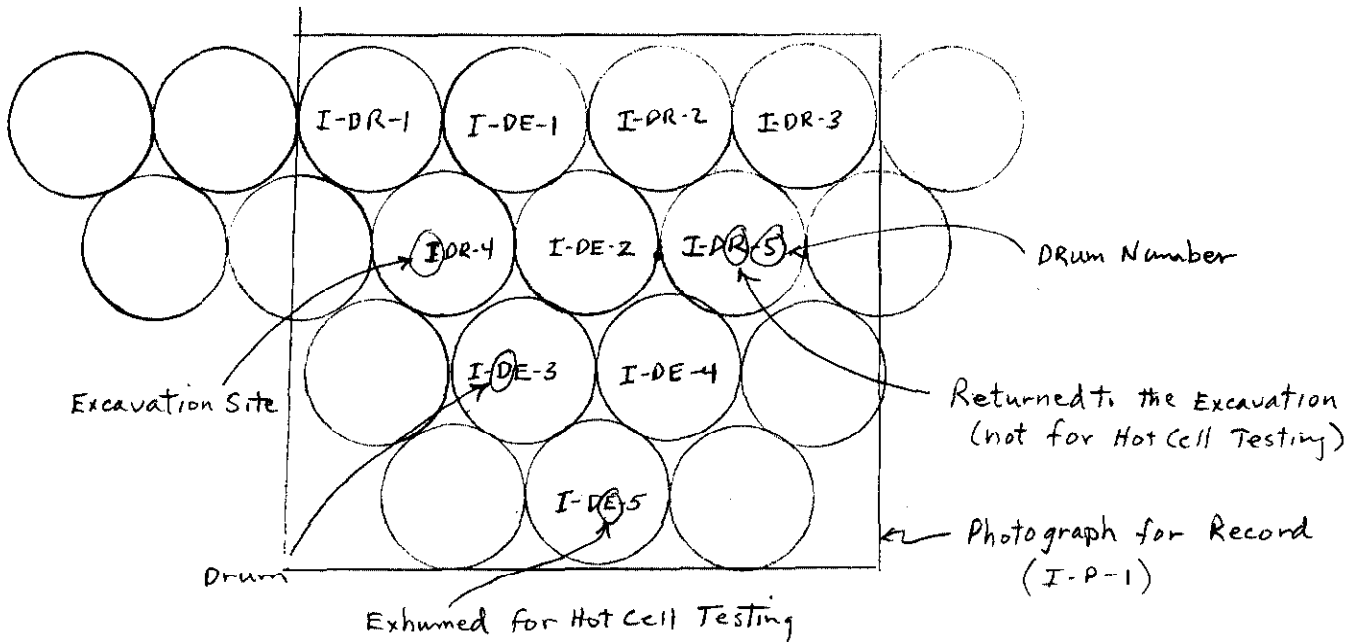
E.....Exhumed

R.....Replaced

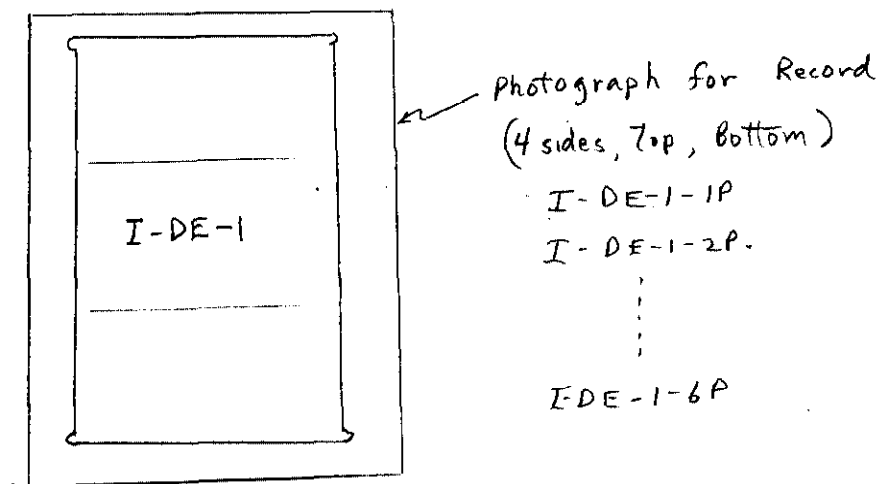
P.....Photographed

### 3. EXAMPLES

- 3.1 Packages will be identified by excavation site, whether the package is removed or left in place and by sequential numbering left to right and top to bottom as you face the drums or boxes from the excavated area. Numbers will be painted on the drum end and side and a metal tag attached.

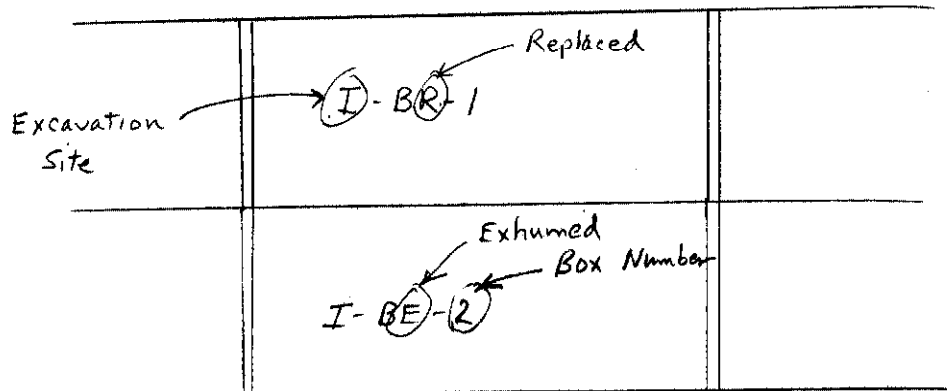


- 3.2 Photographs will be collected at the discretion of the SRWRT Project Engineer. Initially more extensive coverage will be used.



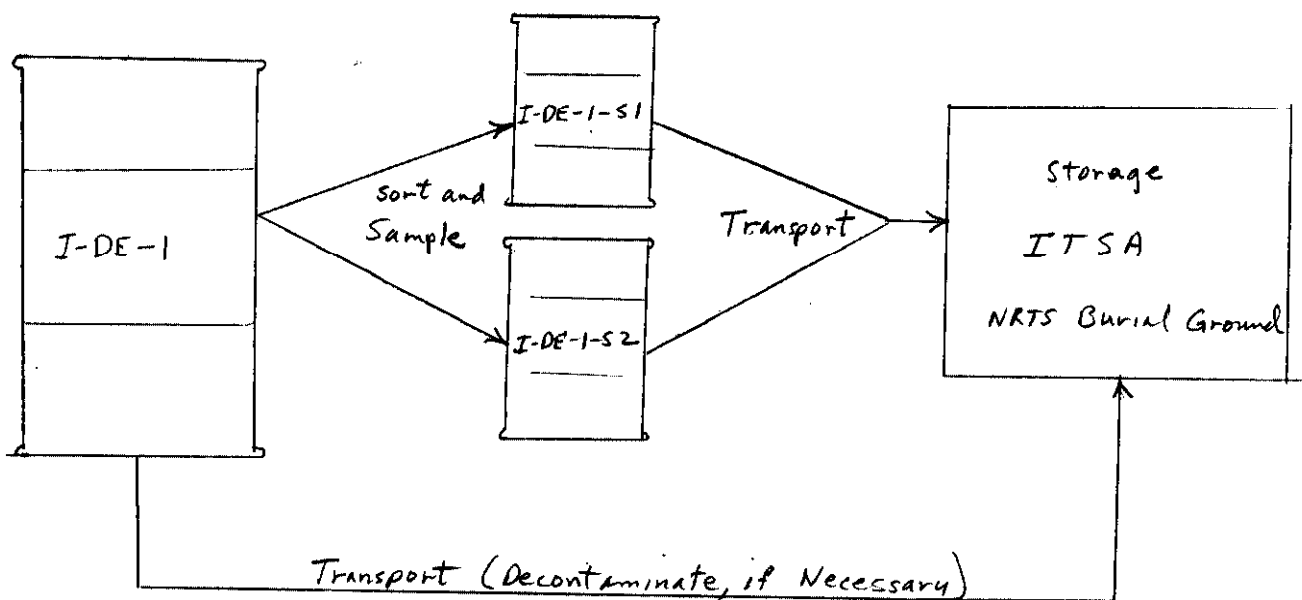
In addition, any unusual conditions shall be photographed.

Similar numbering and photographing techniques shall be used at the site of box excavations. For example,



Box identification number is to be stenciled on all six sides, if possible. Photograph, if possible, all six sides. It may be necessary, due to container conditions, to use an alternative box marking system--such as plastic stapled to the sides.

- 3.3 SRWRT numbering system at the Hot Cell shall be an extension of that used at the burial ground so that containers can be correctly identified throughout the program.



where,  $\begin{cases} S1. \text{ Combustibles} \\ S2. \text{ Non-combustibles} \end{cases}$

The SRWRT numbering system for boxes shall be of the same format as that used for the drums, as the boxes pass to the Hot Cell for sorting and sampling. Any time an "X" appears at the end of a drum or box number, the container will be returned to the excavation site and buried. Refer to the Log Book for details.

- 3.4 Each of the samples collected at the Hot Cell for analysis at ICPP shall have a number such that the sample can be related back to the original drum or box.

3.41 Barrel number plus consecutive sample number, 1, 2, 3, 4, etc.

3.42 Written description plus number in the Log Book.

Sample Number

I-DE-1-1 ← Cotton Glove from Top 1/3 of barrel  
Photo taken I-DE-1-1P

I-BE-1-17 Metal Object (~1/8" x 2" x 4")  
No Photograph

↑  
Sample Number

### 3.5 Soil Samples



As soil samples are collected, an entry shall be made in the Log Book. The entry shall reflect depth of the soil sample and any unusual observations made at the time of collection.

## APPENDIX C

### HOT CELL SORTING AND SAMPLING PROCEDURE

#### Hot Cell Sorting and Sampling Procedure

Prepared by: R. J. Thompson 9-3-71  
R. J. Thompson Date

Approved by: L. T. Lacey 9/7/71  
Allied Chemical Corporation Date

R. B. O'Brien by JRM 9-13-71  
Aerojet Nuclear Company Date

#### 1. PURPOSE

The purpose of this procedure is to define the methods by which container from SRWRT can be sampled and sorted in the ARA hot cell, repackaged, and returned to ITSA at the NRTS Burial Ground.

#### 2. SAFETY

##### 2.1 Health Physics

- 2.11 Contamination Control: Nu-Con Containment Areas<sup>[R]</sup> will be used in the ARA Hot Cell No. 1 for contamination control. Figure C-1a shows a typical Nu-Con device. The Nu-Con device incorporates remote glove handling, absolute filters and a sample-sorting port in the system. The option for inert atmosphere purge can be utilized easily with the system. The floor of the hot cell will be covered with plastic to facilitate decontamination in the event that contamination escapes the Nu-Con system. The Nu-Con containment area will be taped directly to the container being sorted and sampled, thus, providing a double containment-double filtration system; ie, the Nu-Con system and the hot cell. With the Nu-Con system, flammable material in the cell will be kept to a minimum. The floor of the Isolation Room adjacent to the ARA-Hot Cell No. 1 will also be covered with plastic and segregated from other areas by 18-in. high contamination barriers. The hot cell area and Isolation Room are shown in Figure C-1.

Two Nu-Con containment areas also may be employed on the barrels that are being used to hold the sorted waste. After the waste is sorted, the containment devices will be removed and the drums sealed according to Rocky Flats criteria.

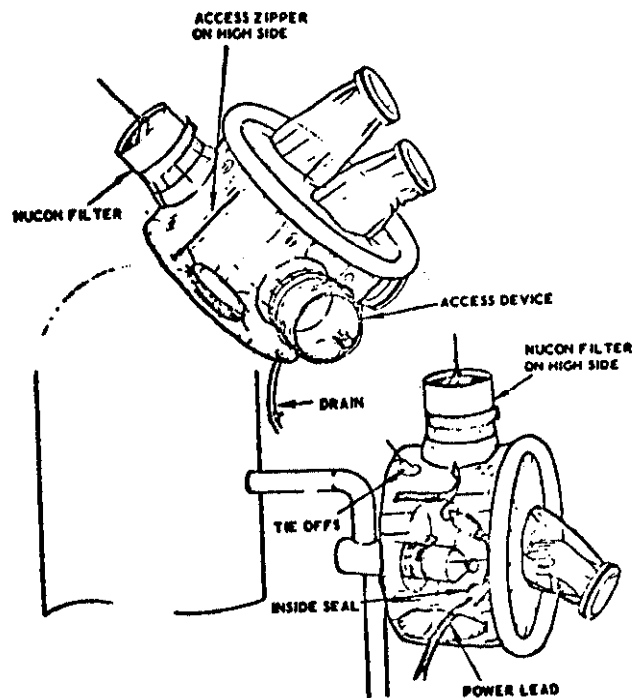


Figure C-12  
TYPICAL INSTALLATION FOR NU-CON CONTAINMENT AREAS  
(TYPE B) OVER A HAND HOLE OR A CAPPED VALVE.

A-26

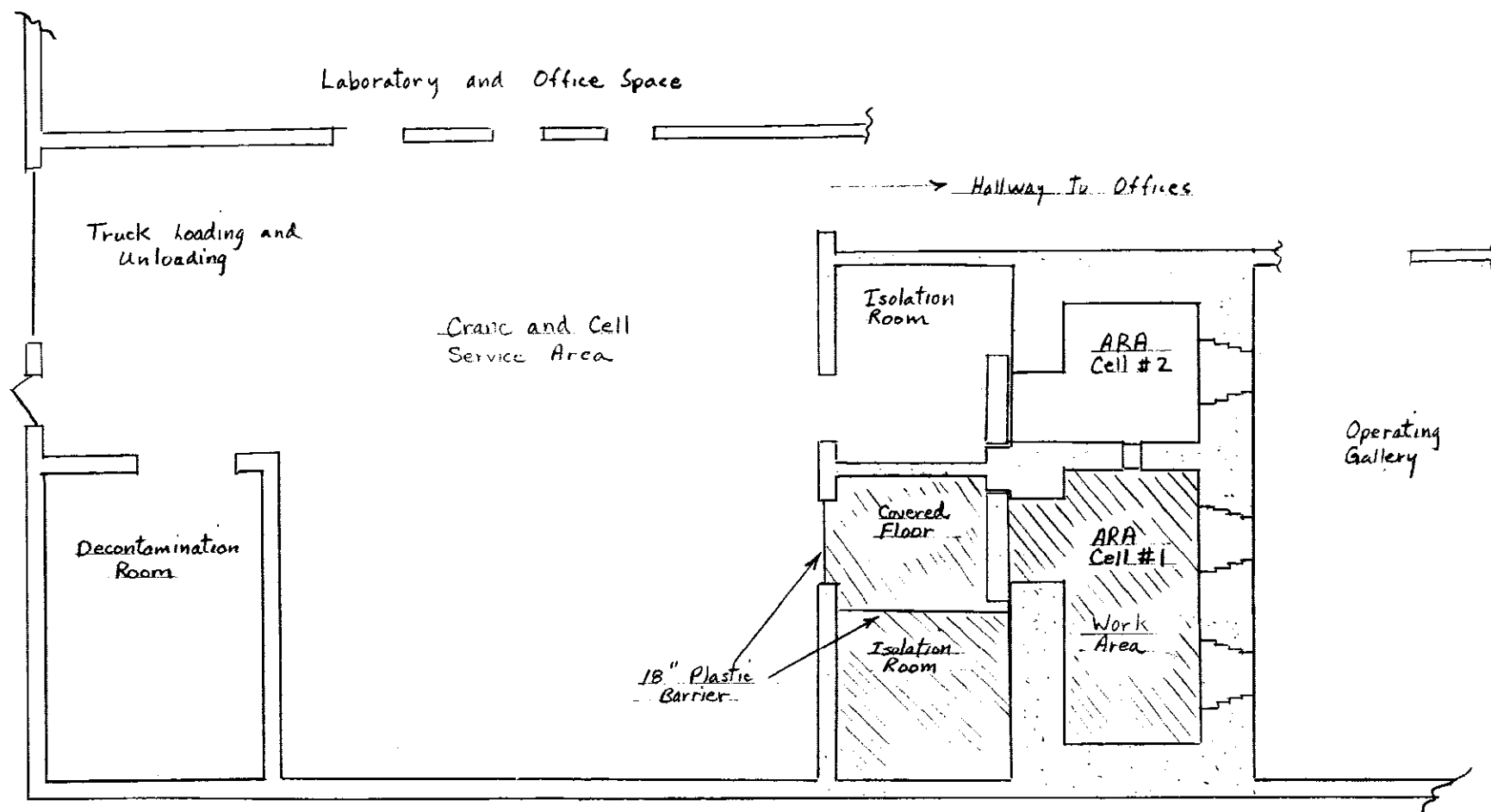


Fig. C-1 ARA Hot Cell No. 1 (ref Dwg AREA/SF-626-A-1).

- 2.12 Respiratory Protection: Personnel in the containment structure shall wear full face mask respirators equipped with particulate filters and which have been leak tested (using stannous chloride smoke).
- 2.13 Protective Clothing: Personnel in the containment structure will wear two pairs of cotton coveralls, one pair of plastic booties, one pair of canvas booties, a cotton hood and two pairs of surgeon's gloves. The plastic booties, external pair of surgeon's gloves, and the cotton hood will be taped to the outer pair of coveralls. In addition, the hood will be taped to the full face mask.
- 2.14 Dosimetry: Personnel in the containment structure will wear film badges suitable for X- and gamma-radiations and film for fast neutrons.
- 2.15 Radiation Detection Equipment: Portable alpha and gamma survey instruments will be operated, maintained, and interpreted. The portable alpha survey instruments will use air proportional probes with a sensitive area of approximately 60 square centimeters. The portable gamma survey instruments will include G-M counters as well as instruments sensitive to low energy gamma rays (60 Kev). Alpha counting equipment will be operated, maintained, and interpreted for counting smears and air samples. Area gamma monitors, nuclear accident dosimeters, stack monitors, and alpha beta ratio constant air monitors are an integral part of the ARA facility. These will be operational during the time this procedure is used.
- 2.16 Air Sampling Equipment: Portable air sampling equipment will be operated in the containment structure and isolation room No. 1. These units will sample the air at a rate of about two cubic feet per minute.

## 2.2 Nuclear Safety

No more than one container at a time will be permitted in the hot cell. Since all containers have less than 200 g Pu, no criticality hazard exists. However, if questions relative to nuclear criticality safety arise during any phase of operations, all activities will be suspended until the problem is reviewed and resolved by the appropriate safeguard personnel.

## 2.3 Fire

Provisions will be made to handle any credible fire. The maximum credible incident in this particular case is the complete burning of the contents of one container. A minimum of two 15-pound CO<sub>2</sub> fire

extinguishers and a 10-gallon can full of MgO sand for extinguishing any fire which may occur in the drum will be provided. These will be in the containment structure. ANC will provide a backup fire fighting system which can be used in the event the Hot Cell must be evacuated. The decision to activate the backup fire fighting system will be made by ANC. ANC will install a rolled sheet of at least 8 mil thick vinyl plastic above the door between the service area and Isolation Room No. 1 prior to opening the first drum. In the event of a fire which requires evacuation of the work area, this sheet will be used to cover and seal the doorway.

#### 2.4 Shipping Containers

Approved DOT barrels or containers will be used to return the sorted waste to the ITSA pad at the NRTS Burial Ground.

#### 2.5 Cleanup and Waste Disposal

After sorting contents into combustibles and noncombustibles and repackaging is complete, all materials and equipment used will be packaged for either disposal to waste storage or for radioactive decontamination.

Materials such as plastic, filters, clothing, etc., will be packaged and disposed as contaminated waste. Disposal will be into 55-gallon drums. These wastes will be sent to the ITSA pad at the NRTS Burial Ground. Equipment which is not contaminated will be returned to service. Equipment which becomes contaminated will be either decontaminated or packaged and disposed as contaminated waste. Efforts will be made to decontaminate equipment prior to deciding which method should be used.

In the event facilities provided by ID and ANC become contaminated with plutonium, these facilities will be decontaminated equal to or less than the levels which existed prior to the work.

#### 2.6 Industrial Safety

Industrial safety rules for operations in the ANC facilities are to be followed. All personnel working in the ANC facilities will familiarize themselves with the building rules and general safety practices for these facilities. An indoctrination will be conducted by responsible ANC personnel prior to starting any work activities.

Communication between inside and outside the cell will be maintained by voice contact through the open cell door. A practice run will be made to determine and solve operating problems that may occur.

### 3. PROCEDURE FOR OPENING DRUMS AND/OR BOXES

Only one container will be in the plastic containment structure at a time. After sorting, the packages will be appropriately spaced to meet criticality limits and Health Physics requirements.

The ring closure will be removed, and the lid opened carefully. An alpha survey will be made to determine if alpha contamination is found, attempts will be made to determine the source so that appropriate action can be taken. If the source of contamination cannot be controlled, the drum will be resealed and stored in the ARA Hot Cell No. 1 isolation room until an alternate method for sorting can be developed. Two feet of separation from other containers will be maintained during this time. The alternate method could involve a remote operation and would require a new plan. When it has been determined that either there is no contamination or that the contamination can be controlled, the plastic barrel liner will be cut and sorting of the barrel contents will proceed. Photographs and sampling will be done at the request of the SRWRT Project Engineer.

Prior to removal, each package will be monitored for alpha contamination. Those packages found contaminated will be rebagged immediately. A gamma measurement will also be made on each package to determine activity level. Records will be kept regarding observations made on each package. After emptying, the drums will be monitored for alpha contamination. If contaminated, they will be disposed of by sealing and returning to ITSA. Present Rocky Flats procedures for packaging wastes will be followed. These include using a double liner, inspecting the liner for holes, adding an adsorbent on top of the liner and sealing the lid using a sealant such as "Permatex".

The drums will be monitored for alpha contamination when they leave the plastic containment structure. More detailed monitoring will be performed outside the plastic containment structure. This will consist of smearing outside surfaces as well as a gamma survey.

### 4. PROCEDURE FOR RETURNING DRUMS TO THE BURIAL GROUND

Drums or boxes of sorted waste will be returned to ITSA at the NRTS Burial Ground. ARA Hot Cell personnel shall contact the following personnel prior to shipment.

4.1 Burial Ground Supervisor

4.2 SRWRT Project Engineer

Approvals and notifications must be obtained before shipment.

## 5. CONTINGENCIES

### 5.1 Fire

If at any time during the operation a fire is observed, the fire department will be notified by the pull box outside the cell. Everyone in the area will immediately don a respirator. Those in the cell will attempt to extinguish the fire using available extinguishing agents. Visitors in the operating area will evacuate the ARA facility. If a fire becomes uncontrollable and/or the temporary containment structure ignites, all personnel in the cell will immediately evacuate the isolation area and a plastic door covering will be taped over the isolation area door. The plastic door covering will have been installed previously above the door so that it is immediately available if necessary. The cell ventilation will be shut off only if prudent in the judgement of ARA Cell personnel. After the fire is extinguished and prior to re-entering the cell, an approved plan will be necessary to enter, decontaminate, and reclaim the cell.

### 5.2 Contamination

If alpha contamination is detected when the lid is removed from a drum, an attempt will be made to locate immediately the source of the contamination, correct the problem, and proceed with the work. If the source of the contamination cannot be located immediately, the lid will be placed on the drum, and the work will cease, pending development of an alternative plan. Until the alternative plan is developed, the drum will be stored in the isolation room with a minimum of two feet of spacing from any other container.

If alpha contamination is detected during the work, immediate corrective actions will be taken to correct the problem and decontaminate the area before proceeding with the work.

## 6. MATERIALS TO BE SUPPLIED BY ANC

- 6.1 Plastic containment structure, including fire-resistant supports.
- 6.2 Portable alpha-monitoring instruments and support supplies.
- 6.3 Portable gamma-monitoring instruments and support supplies.
- 6.4 Shipping containers.
- 6.5 New 55-gallon barrels.
- 6.6 Supplies such as tape, Kimwipes, tools, plastic bags, rubber gloves.
- 6.7 Air sampling equipment and smear papers.

- 6.8 Portable downdraft system.
- 6.9 CO<sub>2</sub> fire extinguishers, MgO sand.
- 6.10 Full face masks, respirators, MSA ventilation smoke tubes.
- 6.11 Protective clothing including coveralls, plastic botties, canvas bottles, safety shoes, etc.
- 6.12 Wooden crates.
- 6.13 Air flow meters.
- 6.14 Can sealer.
- 6.15 Personnel dosimeters.

## 7. RESPONSIBILITIES

The SRWRT Project Engineer is responsible for the technical content and conduct of the program. The ANC Hot Cell Supervisor is responsible for all operational aspects of the hot cell portion of the program. In the event a conflict between technical and operational aspects, the work will be stopped and resolution of the differences achieved.

## APPENDIX D

### SOLID RADIOACTIVE WASTE RETRIEVAL TEST (SRWRT) ANALYTICAL PROCEDURE FOR ALPHA CONTAMINANT DETERMINATION

Prepared by B. A. Staples

This procedure developed by personnel of the Health Services Laboratory, USAEC, Idaho Falls, Idaho, is used to analyze solid materials for plutonium<sup>(1)</sup>. The method has been adapted by personnel of the Radio and Special Analysis Group of the Analytical Chemistry Branch for use on soil samples.

Samples received for analysis are crushed to pass a No. 35 U. S. Standard Sieve and mixed before taking a fraction for plutonium analysis. The sample aliquot taken for analysis is fused with anhydrous potassium fluoride to dissolve siliceous materials after nitric and hydrofluoric acids have been added to decompose silicates. Sulfuric acid and anhydrous sodium sulfate are added to the cooled melt which is heated to obtain a pyrosulfate fusion volatilizing hydrogen fluoride and silicon tetrafluoride. The melt is dissolved in dilute hydrochloric acid and a barium sulfate scavenge is performed on the solution to quantitatively coprecipitate and actinides present. The barium sulfate is filtered from the melt solution and dissolved in acidic 2.2 M aluminum nitrate. The aluminum nitrate is contacted with 30% Aliquot 336 Nitrate in ethylene extracting the tetravalent actinides, including plutonium. Trivalent actinides, lanthanides, barium and aluminum, all of which interfere with the electro-deposition of plutonium, are stripped from the Aliquot 336 with 8 M nitric acid. Thorium is stripped from the organic phase with a hydrochloric acid-hydrogen peroxide mixture. Plutonium is stripped from the organic phase with a perchloric-oxalic acid mixture to which sodium hydrogen sulfate is added. The solution is evaporated to dryness, the residue dissolved in hydrochloric acid, and plutonium electro-plated on to a platinum disk for alpha pulse height analysis<sup>(2,3)</sup>.

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1. C. W. Sill, K. W. Puphal, and F. D. Hindman, Health Services Laboratory, U. S. Atomic Energy Commission, Idaho Falls, Idaho, "Simultaneous Identification and Determination of Alpha-Emitting Nuclides from Radium to Californium in Solids" (manuscript sent to Analytical Chemistry for publication).
2. R. F. Mitchell, Analytical Chemistry, Volume 32, No. 3, p. 326 (1960).
3. K. W. Puphal and D. R. Olsen, Health Services Laboratory, U. S. Atomic Energy Commission, Idaho Falls, Idaho, "Electrodeposition of Alpha-Emitting Nuclides from a Mixed Oxalate-Chloride Electrolyte" (manuscript sent to Analytical Chemistry for publication).

## APPENDIX E

### SOLID RADIOACTIVE WASTE RETRIEVAL TEST (SRWRT) SOLID RADIOACTIVE WASTE RETRIEVAL TEST CONTAINER HANDLING EQUIPMENT

Prepared by J. C. Commander

#### 1. STANDARD EQUIPMENT

##### 1.1 Single Drum Lifter

Basic lifting apparatus is a scissor-action chain tong. Jaws are slide adjusting to handle all diameters of drums within the range of 18 to 24 inches. Apparatus will lift drums vertically--open or closed--and will not damage open top drums. Jaw grip is not affected by oily or greasy surfaces.

##### 1.2 Nylon Slings

Designed for lifting barrels, drums or boxes after they have been placed in plastic bags. They provide safe, soft gentle handling of most difficult loads.

##### 1.3 Steel Chain Slings

Designed for use in a straight pull on loads equipped with eyes or hooks. Can be used as the adaptor link between the crane cable hook(s) and the barrel or box handling equipment.

##### 1.4 Hot Waste Dumpster Containers

Standard Universal Type Dempster containers are constructed of heavy plate braced by steel runners. They are end opening, top opening and have drop bottoms for easy discharge of waste. The Hot Waste Containers are painted yellow and are marked with an appropriate radioactive symbol. The containers are 12-cubic yard capacity and will accommodate a package 70 inches by 54 inches by 84 inches.

#### 2. SPECIAL EQUIPMENT

##### 2.1 Box Hoisting Tong

Basic lifting apparatus is a dual scissor-action tong suspended from a spreader beam. Jaws are constructed of angle iron and will clamp against boxes up to 4' x 4' x 8' in dimension, in order to hoist a

single box from or onto a stack. The tongs will be fabricated by ANC Site Services Division for use in retrieving wooden boxed Pu waste from the NRTS Burial Ground. The equipment will be used for handling boxes which have retained their structural integrity. It will accommodate 4' x 4' x 8' boxes weighing up to 5000 pounds. See Dwg 402714.

## 2.2 Box Hoisting Tong-Tainer

Basic lifting apparatus is a single scissor-action tong attached to twin clam shell sections which can be used to contain and hoist a box which has lost its structural integrity, or which is degraded sufficiently to warrant special care in handling. The apparatus is constructed of standard carbon steel shapes and plate, and will accommodate 4' x 4' x 8' boxes weighing up to 5,000 pounds. See Dwg. 402713.

## 2.3 Tined Box Picker

Basic lifting apparatus is a set of tines rigidly attached to a structural load carrying frame which is fitted with a lifting ring. The equipment is designed to allow removal of structurally sound wooden boxes from their stacked position in the NRTS Burial Ground. The equipment will accommodate 4' x 4' x 8' boxes weighing up to 5,000 pounds. See Dwg 402712.

## 2.4 Tined Barrel Picker

Basic lifting apparatus is a set of tines rigidly attached to a structural load carrying frame which is fitted with a lifting ring. The equipment is designed to remove drums from horizontal stacks or random dumps where the single drum lifter cannot be used due to loss of structural integrity of the drum lid or drums with corroded walls. The equipment will accommodate 55-gallon drums weighing up to 1,500 pounds. See Dwg 402711.

# 3. MOBILE EQUIPMENT

- 3.1 Crane 20-ton with two hoist chains rigged with 4-part single cable, the crane capacity is 30 tons. Rigged with two cable 2 hooks, the crane capacity is 15 tons. The working reach is 50 feet. Boom extensions are available for extending reach. Reduced load capacities become effective with boom fully extended and when boom extensions are used.
- 3.2 Back Hoe - 1-1/2 cubic yard back hoe is available for excavation around the waste pits.

- 3.3 Dozer HD-21 with dozer blade and 12 to 14 carryall scraper is available for removal of overburden from the waste pits or trenches.
- 3.4 Dempster-Dumpster Truck is available for picking up and transporting loaded hot waste containers.
- 3.5 Cherry-Picker is a mobile light duty crane for moving small loads such as barrels.

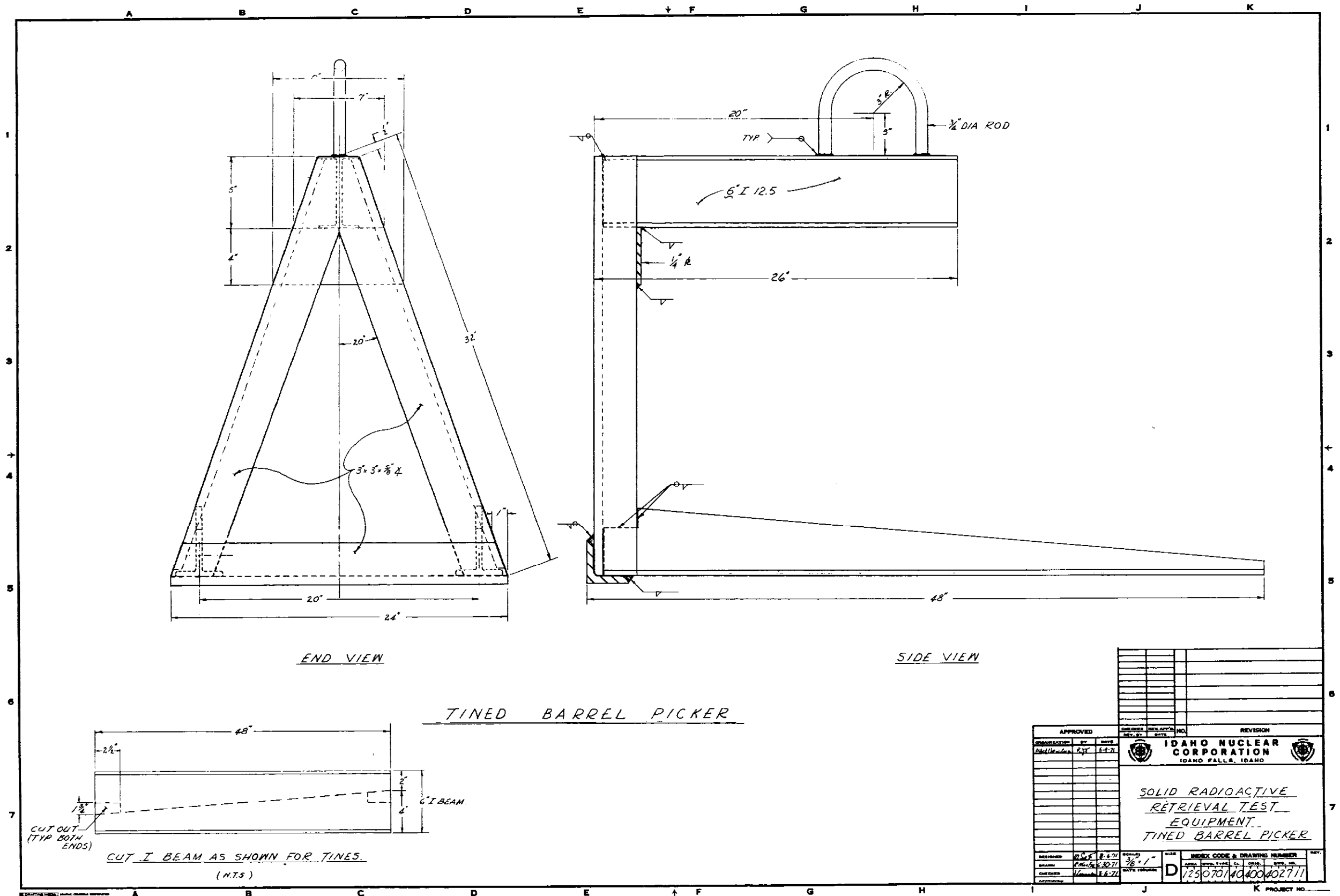


Fig. E-1 SRWRT Equipment - Tined Box Picker (Dwg 402711).

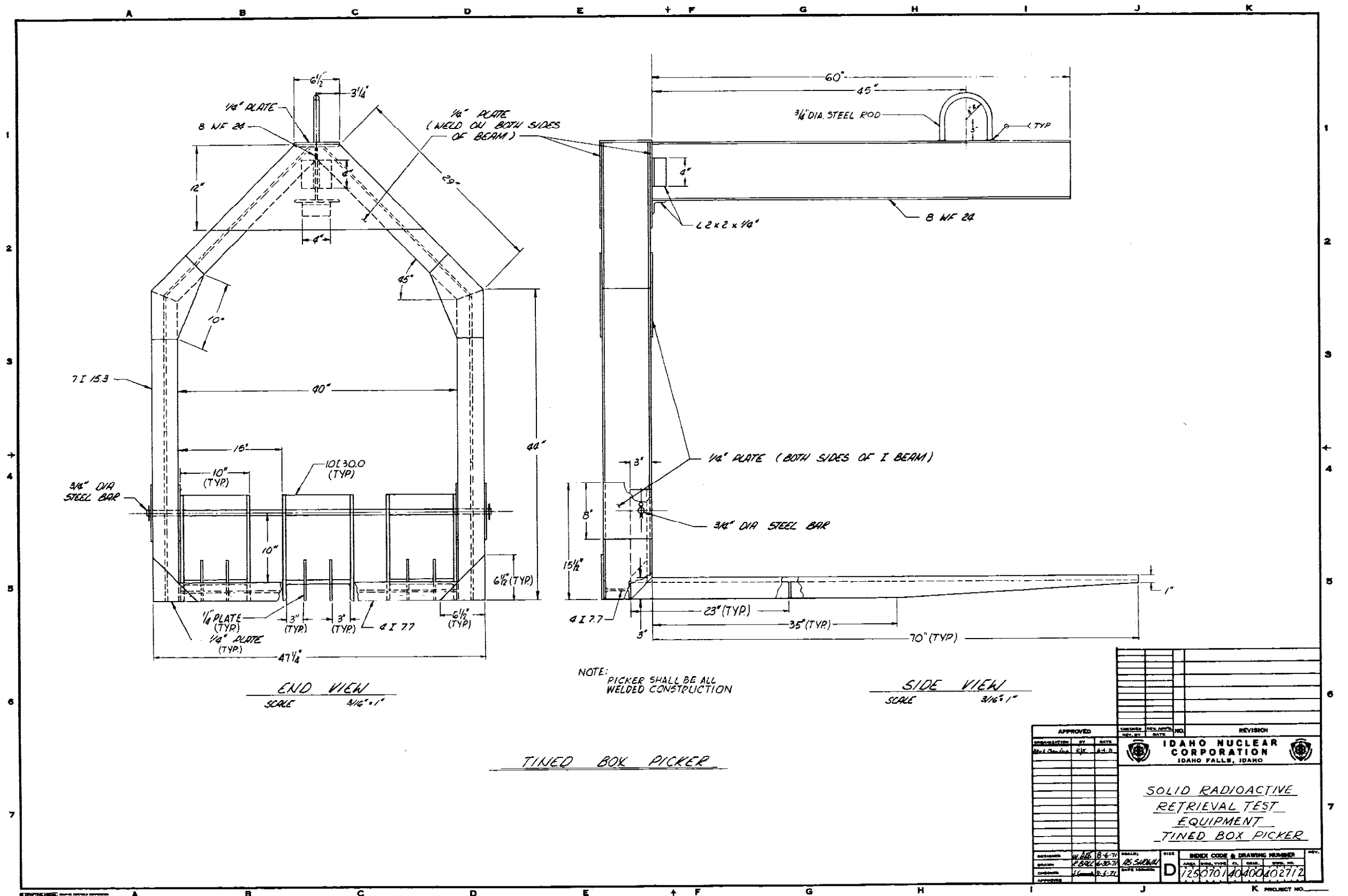


Fig. E-2 SRWRT Equipment - Tined Box Picker (Dwg 402712).

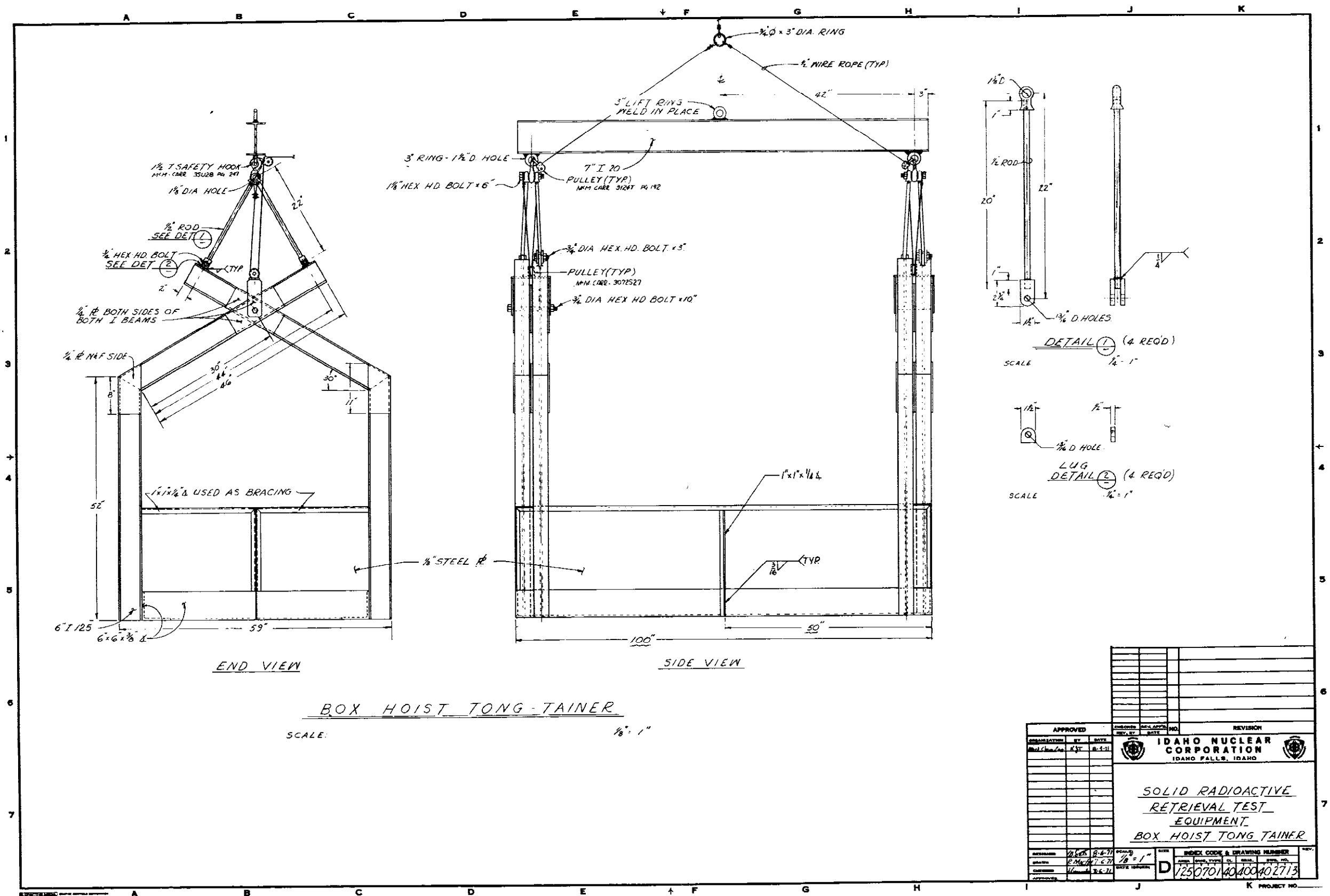
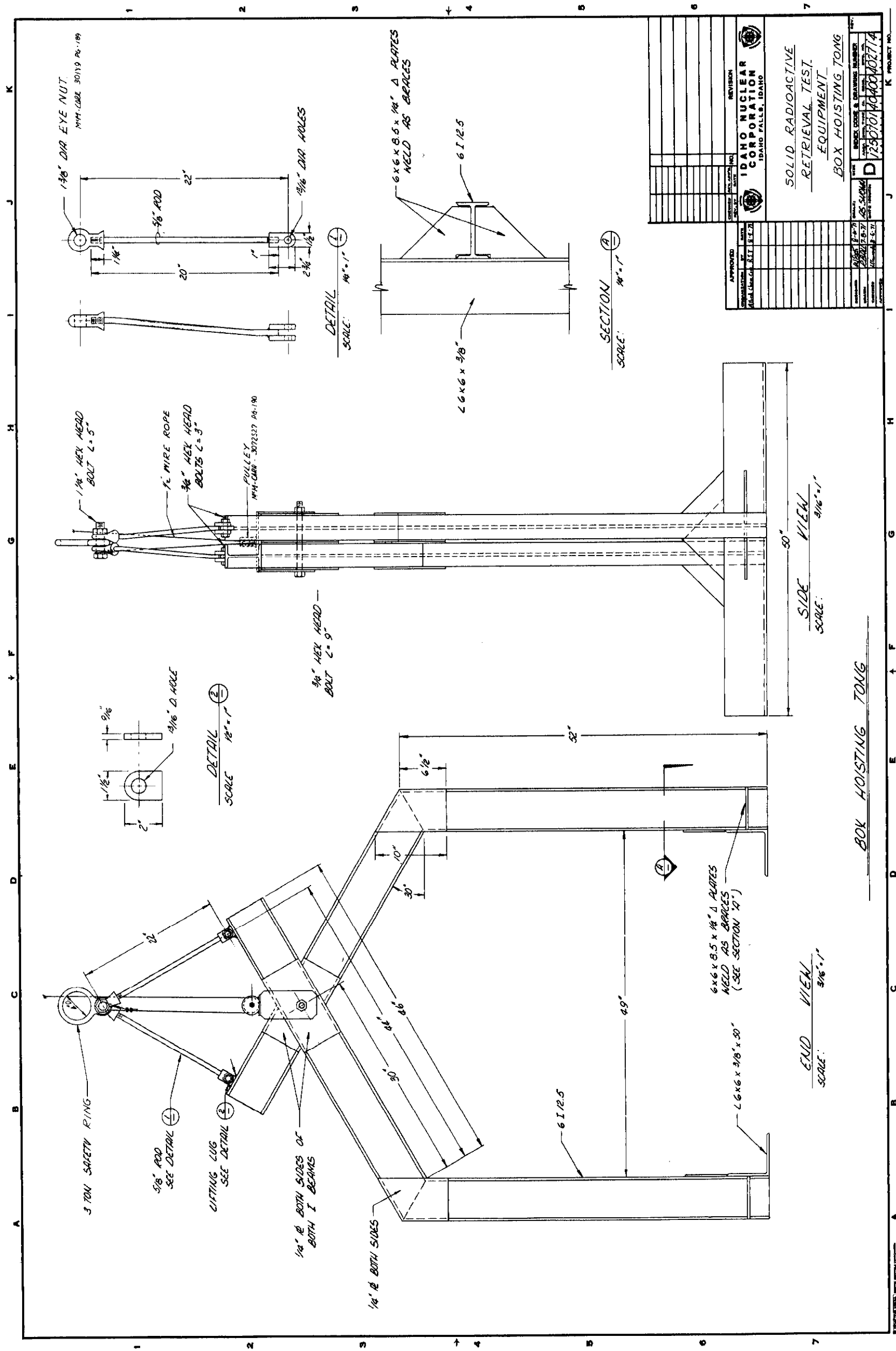


Fig. E-3 SRWRT Equipment - Box Hoist Tong-Trainer (Dwg 402713).



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